Species, size, and location of “giant trees” in Tokyo’s urban area and western suburbs

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Species, size, and location of 'giant trees' in Tokyo's urban area and western suburbs

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Abstract

The Japanese landscape has been characterised by the occurrence of ancient, massive trees described here as 'giant trees', and many of these have had major historic, cultural and religious significance. However, modern Japan has experience significant and rapid urbanisation and in relation to ancient woods and trees, 'cultural severance' too. Observation suggests that the habitat quality of giant trees in urban areas within Japan has been decreasing with increasing human pressure throughout the twentieth century. This study identified the species, size, and locations of the giant trees growing in Tokyo's urban centre and its western suburbs, by conducting field surveys and collecting data from published studies. Classification of sites according to the girth of the tree, with giant trees defined as those with a circumference more than 300 cm, revealed six broad locations: 1) forest and agricultural lands of managed secondary and later abandoned woodland with deciduous, broad-leaved trees; 2) public gardens, comprising useful and ornamental plants introduced from southern Japan; 3) parks, including mostly exotic species; 4) shrine sites, including *Zelkova serrata*, conifers, and evergreen broad-leaved trees; 5) temple sites, including many *Torreya nucifera*; and 6) Imperial lands, with rare species of trees in low numbers. The highest percentage of giant trees (36%) were found in Parks, followed by Temple and Shrine sites with 32%, whereas only 10% were found in other historical places such as in Imperial land and publicly-owned garden sites. The results indicated that historical places dedicated to human activities, as is the case with Temple and Shrine sites, are crucial for protecting giant trees in urban areas. This study also highlights the importance of studying giant tree habitats and history, and identifying the relationships between human activities and living trees.

Keywords: Giant tree; urban area; trunk circumferences; shrine; temple

Introduction

Tokyo (Japan) is a large and significant city inhabited by more than 13 million people. However, the city and its suburbs often experience earthquakes, fires, and floods. The landscape is variable made up of mountainous areas, hilly lands, uplands (plateaus), lowlands, and reclaimed lands (i.e., artificially degraded areas) with large rivers or streams. Buildings including shrines, temples, and other religious structures, as well as parks, schools, factories, and business districts, have been built in these landscapes.

Horticulture developed greatly during the Edo period (sixteenth to nineteenth century) under a national isolation policy and many of the horticultural plants developed at that time are still cultivated, for example, *Chrysanthemum*, *Iris*, *Prunus*, *Rhododendron*, *Rohdea*, and *Wisteria* species (Tsukamoto & Creech, 2015). Many horticultural plants were hybridized with native species distributed around Tokyo's urban area or brought from their original areas in Japan between the northern (cold) and southern (sub-tropical) zones.

Japanese people have long held a deep devotion for natural things; for example, they respected and prayed to mountains, giant rocks, or giant trees as symbols of God (Miyamoto, 2011; Nomoto, 2010), and almost all giant trees are popular symbols within their locations even today. These giant trees are now receiving increasing attention for both their horticulture and ecology. However, the recent construction of high-rise buildings, roads, and other structures linked to human activity has put pressure on many trees and on their sites. Furthermore, the breakdown of the intimate connections between people and nature in these landscapes, 'cultural severance' (Rotherham, 2008), has triggered to a loss of interest in the trees and their significance. This has exacerbated the decline in urban areas and suburbs. Simultaneously, the quality of giant tree habitats has deteriorated resulting in their decline and/or death, in some cases resulting from damage during construction work. Thus, a knowledge of the background of living giant trees is important not only regarding ecological conditions including landscape, climate, and soil, but also social conditions, such as religion or customs.

Although information on giant trees has been published in books and is available on the Internet, the data are not consistent (e.g. differing numbers of trunks and trunk circumferences) and, therefore the need to compile a unified report concerning extant giant trees was identified. Thus, the present study investigated the relationships between humans and giant trees within Tokyo and its western suburbs, by reporting the species, size, and location of giant trees in seven types of landscape classified according to the human activities: i) Forestry and agricultural land (producing wood or food); ii) Graveyards, for burial and prayer; iii) Temple or shrine sites, for prayer; iv) Parks and public gardens for rest, recreation, or education; v)

School sites, for education; vi) Residential areas; and vii) Public roads.

Methods and Study area

Methods

Giant trees were selected based on the definition provided by the Ministry of the Environment (former Environment Agency, 1991) as follows: trunk circumference was measured at 1.3 m from ground level, and a tree was considered giant if its trunk circumference was larger than 300 cm (single trunk tree). However, if trees had multiple trunks originating from the same root system, the trunk circumferences were added together and judged to be 300 cm or more.

Single visits to record data were made to each giant tree between May 8, 2015 and May 20, 2017. The field survey data was integrated with information retrieved from published studies accessed via the official websites (Japan Tree Doctors Association Kanagawa Branch, 2010; Kawasaki City, 2016; Okutamamachi-Nippara-Shinrinkan, 2015; Yokohama city, 2016).

A cluster analysis was performed using the Ward method in Statistics 2008 (Social Survey Research information Co., Ltd.) for Microsoft Excel 2016. This was in order to characterise every location in terms of giant tree species and size.

Study area

The study was conducted in Tokyo's urban area and western suburbs (Tokyo city, Kawasaki city, Aoba ward, Tsuzuki ward, Kohoku ward and Tsurumi ward), located along the River Tamagawa, as shown in Figure 1. Landscape was variable in the study areas: mountains in the northwest; hills on the west; uplands in the central to eastern Tamagawa River; lowlands near the coast and reclaimed lands (artificially re-graded areas) (Kanagawa Prefecture Government, 1975; Tokyo Metropolitan Government, 1976).

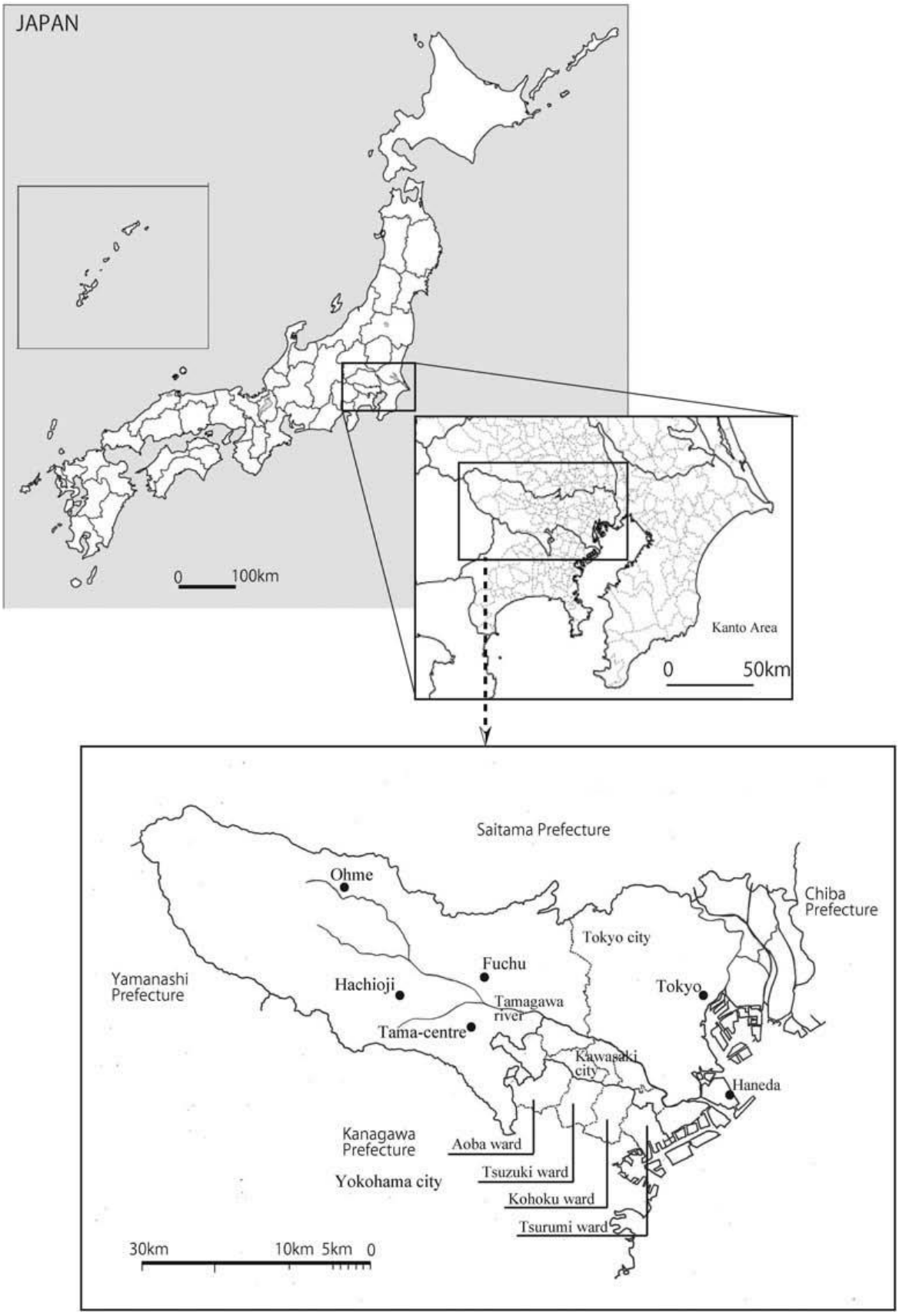

Figure 1. Study area within Tokyo and its western suburbs. Tokyo City, Kawasaki City, Aoba Ward, Tsuzuki Ward, Kohoku Ward and Tsurumi Ward. Modified from http://www.sekaichizu.jp/atlas/japan/p800_japan.html.

The land category was specified based on the primary use of the land according to its categorization on the Real Property Registration Act, Ordinance on Real Property Registration (Ordinance of the Ministry of Justice No. 18 of February 18, 2005) Article 99, and Ordinance on Real Property Registration, secretary-handling manual, observance of a rule (Ordinance of the Ministry of Justice, Civil Affairs Bureau 2 notification, No. 456 of 2005), Article 68. The land categories represented in these laws included twenty-three sub-categories: rice field, field for other crops, residential land, school site, railway site, salt field, mineral spring site, pond and swamp, forest, stock farm, wilderness, graveyard, temple or shrine site, canal site, waterworks site, irrigation and drainage, storage reservoir, bank, well and ditch, protected forest, public road site, park, and miscellaneous site. However, for the present study these sub-categories were modified to make them more relevant with some, based on their similarity, merged while others were further divided. This resulted in us using seven main land types:

i) Forest and agricultural land, which includes rice fields, fields for other crops, ponds and swamps, forests, stock farms, and wilderness sites, as well as the Special Green Space Conservation Districts (Urban Green Space Conservation Act, Article 12 of 1973) different from the ones mentioned above;

ii) Graveyards;

iii) Temple or shrine sites, which included different species of giant trees sub-divided into iii) a. Temple sites and iii) b. Shrine sites;

iv) Park and public gardens, which were classified into iv) a. Parks, where the main activities are recreation or rest, and iv) b. Public gardens, where the main activity is nature appreciation, including botanical gardens and traditional Japanese gardens;

v) School sites, including day-care centres, kindergartens, primary, junior high, and high schools, colleges, and universities;

vi) Residential areas, including buildings and facilities that bring benefits to inhabitants and require maintenance. Because the contents, and the frequency or degree of residential areas were different, these were further divided into vi) a. Public facility sites (city or municipal hall, hospital, government land or building); vi) b. Private or corporate site (house, factory, warehouse), and vi) c. Imperial land; and,

vii) Public road. Railways, salt fields, mineral springs, canals, waterworks, irrigation and drainage, storage reservoir, bank, well and ditch, protected forest, and miscellaneous sites that were not habitats for giant trees.

Results

Species, number, and location of giant trees

The 2,107 giant trees identified across the seven landscape-types, belonged to 36 families, 51 genera, and 75 species (Table 1). They included the 1,114 giant trees observed in the field study plus other giant trees in published studies (Japan Tree Doctors Association Kanagawa Branch, 2010; Kawasaki city, 2016; Okutamamachi-Nippara-Shinrinkan, 2015; Yokohama city, 2016). Most species (75%) were Angiospermae: Dicotyledoneae: Choripetalae (35 genera, 58 species), followed by Gymnospermae (13 genera, 14 species; 24%). Within Choripetalae, *Platanus* species included *P. orientalis* L., *P. occidentalis* L., and *P.* x *acerifolia* (Aliton) Willd.; *Populus* species included both *P. angulata* Aiton and *P. nigra* var. *italica* Koehne; and one unknown *Prunus* sp. represented common cherry blossoms. Angiospermae: Dicotyledoneae: Sympetalae were only represented by three genera and three species (under 1% in total). Exotic giant trees (n = 137; 7%) belonged to 11 genera (species).

Parks (iv) a. had the highest number of giant trees, followed by shrines (iii) b. (with half the number found in parks), temples (iii) a., and forest and agricultural land (i). The number of giant trees in public gardens (iv) b. was far less than that found at these other sites. Only a few giant trees were found at schools (v), on Imperial lands (vi) c., in private or corporate sites (vi) b., graveyards (ii), and public facilities (vi) a., and only ten were found along public roads (vii).

Total trunk circumference of each giant tree species

Using the cluster analysis technique (Figure 2), the giant tree species were classified into six groups (I to VI) with a correlation coefficient of 2.95. Figure 3 displays the list of species found within each site and their total trunk circumferences, in the order evidenced in the cluster analysis.

All species which belong to Group I, II and III were commonly located in Parks. However, *Prunus jamasakura* Sieb. ex Koidz., *Quercus serrata* Thunb. ex Murray, *Q. myrsinifolia* Blume, and *Carpinus tschonoskii* Maxim. (i.e. Group I) were mostly located in Forest and agricultural land. Group II species (*Cinnamomum camphora* (L.) Presl., *Aphananthe aspera* (Thunb.) Planch., and *Machilus thunbergii* Sieb. et Zucc.) were mostly located in Public gardens. Group III species (*Platanus* spp., *Prunus* x *yedoensis* Matsumura, *Cedrus deodara* Loud., *Celtis sinensis* Pers. var. *japonica* (Planch.), and *Liriodendron tulipifera* L.) were mostly located in Parks.

Group IV species (*Ginkgo biloba* L., *Zelkova serrata* (Thunb.) Makino, *Castanopsis sieboldii* (Makino) Hatusima *ex* Yamazaki *et* Mashiba, *Cryptomeria japonica* (L. fil.) D. Don, *Quercus acuta* Thunb. ex

Murray and *Pinus thunbergii* Parlatore) were mostly located in Shrine sites whilst most *Torreya nucifera* (L.) Sieb. *et* Zucc. and some *Aesculus turbinata* Blume, *Quercus sessilifolia* Blume, *Litsea coreana* Léveillé, and *Prunus pendula* Maxim. f. *pendula* (Group V) were located in Temple sites. Imperial land sites included *Liquidambar formosana* Hance, *Distylium racemosum* Sieb. et Zucc., and *Gleditsia japonica* Miq. (Group VI species).

Species and size of giant trees at each location

As evidenced by the cluster analysis, giant trees were found in park sites, forest and agricultural lands, temple and shrine sites, public gardens, and residential lands (especially Imperial land) allowing classification of each site according to the species found. On the contrary, species distributed in schools, graveyards, residential land (public facility or private or corporate sites), and public road sites did not allow such classification. People have cut down giant trees in these area, since these giant trees obstruct to make enough space to do human activity. The species, their characteristics and trunk circumferences for each of the seven landscape site types are listed below. The landscape types are listed in descending order of percentage of giant trees found in each landscape, as follows:

- **Park:** Thirty species of giant trees were found (Figure 4), including several exotic species, such as *Platanus* spp., *C. deodara*, and *L. tulipifera*, and hybrids of horticultural plants such as *P.* x *yedoensis*. Twelve species had the highest largest trunk circumferences, with the exotic *Platanus* spp. and *Acer buergerianum* Miq. recorded at 851cm and 921 cm, respectively. Many deciduous trees and conifers were also present in the parks, together with *C. camphora*, *C. sieboldii*, *Q. myrsinifolia*, *Ligustrum lucidum* Ait., and *Q. acuta*. The number of trees decreased as trunk circumference increased, and this decrease was particularly rapid beyond 500-cm trunk circumference, except for *C. deodara* (none over 400 cm) and *P. jamasakura* (the most abundant). The only giant tree with 800-cm to 900-cm trunk circumferences was *P. jamasakura*; these had several trunks and were mostly distributed in areas of coppice or substitution forest within the Park.
- **Forest and agricultural land:** As shown in Figure 5, this site had numerous coppice trees, including *P. jamasakura*, *Q. serrata*, *C. tschonoskii*, and *Q. myrsinifolia*. As in Park sites, *P. jamasakura* was present in high numbers with many 500-cm to 600-cm trunk circumference trees, as this species had several trunks. In addition, there were also many giant trees which had trunk circumferences from 400 cm to 500 cm, namely *Q. serrata*, *C. tschonoskii*, *Q. myrsinifolia*, *Prunus grayana* Maxim., *Magnolia obovata* Thunb., and *Swida macrophylla* (Wall.) Soják. *Carpinus tschonoskii* and *Q. myrsinifolia* showed a higher frequency of 500-cm to 600-cm trunk

circumferences than other

species. The species of giant trees showing the largest trunk circumferences in this type of landscape were generally rare in others.

- **Shrine sites:** As shown in Figure 6, *Z. serrata* and *G. biloba* were the most abundant species, followed by *C. sieboldii*, *C. japonica*, *P. jamasakura*, *C. camphora*, and *Q. myrsinifolia*. Almost all these giant trees had 300-cm to 400-cm trunk circumferences, although many *Z. serrata, G. biloba*, *C. sieboldii*, *C. japonica*, *P. jamasakura*, and *C. camphora* had 500-cm to 600-cm trunk circumferences. The largest trunk circumferences were registered in *Z. serrata* and *C. sieboldii.*
- **Temple sites:** Giant tree species in this type of site were similar to those found at the shrine sites, and *G. biloba* and *Z. serrata* were particularly abundant (Figure 7). *T. nucifera*, *C. japonica*, *P. thunbergii*, *Sciadopitys verticillata* (Thunb.) Sieb. et Zucc., *Q. sessilifolia*, *L. coreana*, *P. pendula* f. *pendula*, and *A. turbinata* showed the largest trunk circumferences among giant trees located at Temple sites. Most trunk circumferences of *T. nucifera*, *C. sieboldii*, *P. jamasakura*, and *C. japonica* were 400 cm to 500 cm or 500 cm to 600 cm. Although *T. nucifera* grew in shrine, park, Imperial land, and private or corporate sites (Table 1), it was more abundant in the temple sites.
- **Public gardens:** As shown in Figure 8, giant *C. camphora*, *Z. serrata*, *G. biloba*, *C. sieboldii*, and *A. aspera* found at the temple and shrine sites were also observed here, although in fewer numbers. *Pinus densiflora* Sieb. et Zucc. and *Cephalotaxus harringtonia* (Knight) K. Koch were characteristic of public garden sites, as they hardly grew at other sites. Some exotic trees, namely *A. buergerianum* and *C. deodara* observed in parks were also observed in Public gardens (Figure 4). Trunk circumferences of *A. buergerianum* reached 600 cm to 700 cm, although most were 400 cm to 500 cm. *C. deodara* had trunk circumferences under 500 cm.
- **Imperial land:** Only a few giant trees grew on Imperial land, as shown in Figure 9. One unique species was located here, and 10 species showed the largest overall trunk circumferences: *C. deodara*, *D. racemosum*, *Metasequoia glyptostroboides* Hu et Cheng, *Podocarpus macrophyllus* (Thunb.) D. Don, *Neolitsea sericea* (Bl.) Koidz., *L. formosana*, *G. japonica*, *Phellodendron amurense* Rupr., *Ilex integra* Thuunb., and *Elaeagnus multiflora* Thunb. f. *orbiculata* (Makino) Araki.
- **School, Private or corporate, Graveyard, Public facility, and Public road sites:** Only 15 giant trees were found at these sites at most, and they belonged to just a few species (Table 1). Almost all species, i.e., *Z. serrata*, *G. biloba*, *C. camphora*, *C. sieboldii*, and *A. aspera* also grew at others sites,

and there were no exotic plants. Along public roads, only three species of Ulmaceae were found and *Z. serrata* showed six giant trees. At graveyard sites, many *C. sieboldii* were found, together with *Z. serrata*, *C. camphora*, and *Prunus* spp.. The giant trees at these sites had 300-cm to 400-cm trunk circumferences, mostly, but those at private or corporate sites, namely *C. camphora, P.* x *yedoensis,* and *C. sieboldii*, had 500-cm to 600-cm trunk circumferences; *P. thunbergii, T. nucifera,* and *Quercus glauca* Thunb. ex Murray, 400-cm to 500-cm trunk circumferences. The largest trunk circumferences were found for *C. camphora* (850 cm), *P.* x *yedoensis* (700 cm), and *M. thunbergii Sieb. et Zucc.* (680 cm) that were located in private or corporate sites.

Discussion

There were 2,107 giant trees recorded in Tokyo's urban area and its western suburbs. These trees belonged to seventy-five species, and included both broad-leaved trees and conifers. Most giant trees (36%) were located in Parks, followed by Shrine and Temple sites. The total number of giant trees in Shrine and Temple sites combined was almost equal to that obtained in Parks and corresponded to 32% of all giant trees. The *G. biloba* and *C. sieboldii* trees located in Shrine and Temple sites accounted for 57% and 40% of the giant trees within these sites, respectively. The presence of several giant trees in these sites can be attributed to traditional Japanese customs and religion. In the past, the Japanese people prayed to mountains, large rocks, or giant trees as substitutes for God (Nomoto, 2010). In fact, many giant trees still have a fixed sacred straw-rope and are used as praying sites (Figures 10 & 11). Many conifers, including *C. japonica*, *P. thunbergii*, *G. biloba*, and *T. nucifera* were also found in Shrine and Temple sites because their special triangular form, with the top vertex pointing up, is a good substitute for God. However, it is still unclear whether temples or shrines were built near giant trees or if these were planted near the religious sites. Nevertheless, whatever the sequence of origination, Shrines and Temples seem to be important sites for giant trees to grow, in addition to Parks, and Forest and Agricultural Lands. Overall, the results indicate that Tokyo's giant trees have an association with human life-style and activities.

The classification of the investigated areas based on its most abundant species revealed six groups: Forest and agricultural lands, characterized by substitution (coppice) forest plants, including many deciduous, broad-leaved trees such as *P. jamasakura, Q. serrata,* and *C. tschonoskii,* and the evergreen *Q. myrsinifolia;* Public gardens are characterised by useful and ornamental plants introduced from south Japan, including *C. camphora, A. aspera*, and *M. thunbergii*. Parks, have exotic species and hybrids such as *Platanus* spp., *C. deodara, L. tulipifera,* and *P.* x *yedoensis*. Shrine sites typically hold *Z. serrata,* conifers (*G. biloba*, *C. japonica*, and *P. thunbergii*), and evergreen broad-leaved trees (*C. sieboldii* and *Q. acuta*),

and Temple sites have *T. nucifera*. The Imperial lands were found to be typified by rare species in low abundance, such as *L. formosana, D. racemosum,* and *G. japonica*.

Detailed data were collected concerning trunk circumference size (divided into 100-cm intervals) in each of the seven sites studied (forest and agricultural land, public gardens, parks, shrine sites, temple sites, Imperial land, and other sites, which included school, private or corporate, graveyards, public facility, or public road sites), and these provided further information. This information revealed that giant *P. jamasakura, Q. serrata, C. tschonoskii*, and *Q. myrsinifolia* with 400-cm to 500-cm or 500-cm to 600-cm trunk circumferences were most abundant in forest and agricultural lands than at other sites. These trees have several trunks arising from a single root, and almost all were substitution-forest trees (coppice) used for charcoal production until the 1950s. Public gardens comprised many *C. camphora* and *A. aspera* along *P. densiflora* and *C. harringtonia. Pinus densiflora* is a representative species of the succession of trees in the bare area of central Japan (Hayashi, 2003), and *Cinnamomum camphora, A. aspera* and *C. harringtonia* are able to grow in poor soil conditions. The giant exotic trees found in park sites showed the largest trunk circumferences, although they were planted after World War II; almost all park sites were wastelands and exotic trees were planted for the rapid re-vegetation of these sites.

Z. serrata and *C. sieboldii* were the most abundant trees in shrine sites whereas *Ginkgo biloba* and *T. nucifera* were most abundant in temple sites. The reason for this difference is not clear, although the highest abundance of *T. nucifera* (conifer) in temple sites is probably related to its triangular (pyramidal) form, as people easily worship this tree form. Giant trees located in temple sites had larger trunk circumferences than those in shrine sites, suggesting that the former were older.

Liquidambar formosana, D. racemosum, N. sericea, I. integra, and *E. multiflora* f. *orbiculata* were only found on Imperial lands, as single trees or in few numbers, and, albeit presenting large trunk circumferences, these trees were short. *Cedrus deodara* and *M. glyptostroboides* showed the largest trunk circumferences among these giant trees. Thus we conclude that Imperial lands are important sites for the protection of giant trees.

Only a few giant trees (n = 15) were located in school, private or corporate, graveyard, public facility, and public road sites, and were mostly *G. biloba*, *Z. serrata, C. camphora, C. sieboldii*, and *A. aspera*; these species were observed at almost all sites, and there were no unique species. Except for those planted at private or corporate sites, these giant trees were planted by the public administration. The reason why one *C. camphora* at a private or corporate site presented a large trunk circumference was because Daimyo, a Japanese feudal lord, lived in the premises and kept the giant trees until the early twentieth century (Shiba,

2009). Associated with their rapid growth, large *P.* x *yedoensis* and *M. thunbergii* were also found.

Overall, the results presented here indicate that giant trees need to be protected, irrespective of species. The fact that no unique species or very large trees were found in school, private or corporate, graveyards, public facility, and public road sites, is a result of the recent tree cutting of trees to construct new buildings. It seems that this is often done to cut costs or for speed of construction. This loss of 'giant trees' is despite the fact that tree transplantation is customary in Japan. A new law has also established that kindergartens can be built in parks (Cabinet decision, 2017) and this will probably lead to the further cutting of many more giant trees. Thus, although traditionally, most Japanese communities had protected giant trees as 'God substitutes', locating them in shrine or temple sites reminds us of the importance of giant trees. In this context, understanding their habitats and history is crucial to protecting them. The data presented here help to fill a gap in this knowledge and may be used to develop further studies on giant tree species.

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Table and Figure legends

Table 1. Number of giant tree species found in Tokyo's urban area and its western suburb areas, categorized based on the primary use of the land. *Platanus* spp. are *P. occidentalis*, *P. orientalis*, and *P.* x *acerifolia*. *Populus* include both *P. angulata* and *P. nigra* var. *italic*. *Prunus* sp. is an unknown species corresponding to common cherry blossom.

Figure 1. Study area within Tokyo and its western suburbs. Tokyo City, Kawasaki City, Aoba Ward, Tsuzuki Ward, Kohoku Ward and Tsurumi Ward. Modified from http://www.sekaichizu.jp/atlas/japan/p800_japan.html.

Figure 2. Cluster analysis based on trunk circumference size. All trees were considered, except those from unknown locations.

Figure 3. Trunk circumference size of giant trees within each species. The species are ordered according to the classification obtained in the cluster analysis.

Figure 4. Number of giant trees and their trunk circumference sizes at 'park sites'. Trunk circumference size is indicated in 100 cm intervals species are presented in descending order of their abundance. # indicates exotic plants. Species of two giant trees were omitted. Numbers displayed next to the bars indicate the largest trunk circumference size among all giant trees and the number between parentheses indicates the number of trunks where circumference size was measured.

Figure 5. Number of giant trees and their trunk circumference sizes at 'forest and agricultural land sites'. Trunk circumference size is indicated in 100 cm intervals; species are presented in descending order of their abundance. Species of two giant trees were omitted. Numbers displayed next to the bars indicate the largest trunk circumference size among all giant trees and the number between parentheses indicates the number of trunks where circumference size was measured.

Figure 6. Number of giant trees and their trunk circumference sizes at 'shrine sites'. Trunk circumference size is indicated in 100 cm intervals; species are presented in descending order of their abundance. Species of two giant trees were omitted. Numbers displayed next to the bars indicate the largest trunk

circumference size among all giant trees and the number between parentheses indicates the number of trunks where circumference size was measured.

Figure 7. Number of giant trees and their trunk circumference sizes at ‘temple sites’. Trunk circumference size is indicated in 100 cm intervals; species are presented in descending order of their abundance. Species of two giant trees were omitted. Numbers displayed next to the bars indicate the largest trunk circumference size among all giant trees and the number between parentheses indicates the number of trunks where circumference size was measured.

Figure 8. Number of giant trees and their trunk circumference sizes at ‘public garden sites’. Trunk circumference size is indicated in 100 cm intervals; species are presented in descending order of their abundance. # indicates exotic plants. Species of two giant trees were omitted. Numbers displayed next to the bars indicate the largest trunk circumference size among all giant trees and the number between parentheses indicates the number of trunks where circumference size was measured.

Figure 9. Number of giant trees and their trunk circumference sizes at ‘Imperial land sites’. Trunk circumference size is indicated in 100 cm intervals; species are presented in descending order of their abundance. # indicates exotic plants. Species of two giant trees were omitted. Numbers displayed next to the bars indicate the largest trunk circumference size among all giant trees and the number between parentheses indicates the number of trunks where circumference size was measured.

Figure 10. Giant *Quercus myrsinifolia* in the Toyokashima Shrine, Imokubo, Yamato City, Tokyo, on September 27, 2015.

Figure 11. Giant *Quercus sessilifolia* in Kurogane Srine, Aoba Ward, Yokohama City, Kanagawa Prefecture on February 12, 2017.